Clinical Diagnosis and Non-Verbal Ability of Primary-One School Children with LD

Toh Teck Hock[1,2], Wong See Chang[1,2], Muhamad Rais Abdullah[3]

[1] *Department of Paediatrics, Sibu Hospital, KM 9, Oya Road, 96000 Sibu, Sarawak, Malaysia*
[2] *Lau King Howe Memorial Children Clinic, Divisional Health Office, Sibu, Sarawak, Malaysia*
[3] *Divisional Health Offices, Sibu, Sarawak, Malaysia*

ABSTRACT

Introduction	More school children were referred for learning difficutly (LD), especially after the introduction of LINUS sccreening programme by Ministry of Education Malaysia.
Aims	To study the clinical diagnosis and non-verbal ability of primary-one school children with LD after paediatric assessment, as well as associated behavioural issues and socio-economincal background.
Methods	Assessment findings by Paediatricians and Naglieri Non-Verbal Ability Test® (NNAT®) results of all primary-one school children referred in year 2010 with LD were studied retrospectively.
Results	Ninety-three children were included (62.4% male), and 72.0% of them failed the LINUS screening programme. The commonest diagnoses were Borderline Intellectual Disability (ID, 37.6%) and Mild ID (19.4%). Other diagnoses included Attention Deficit Hyperactive Disorder (ADHD, 11.8%), Specific Learning Disability (SLD, 10.8%), Autistic Spectrum Disorder (n = 5) and Severe Language Disorder (n = 3). Mean NNAT scores were 84.6 ± 11.8 (n = 85), of which 9.4% children scored less than 70 (<2nd percentile), while 63.7% scored between 71 and 90 (3rd-24th percentile). Twenty-three children (27.1%) scored 90 - 110 (25th-75th percentile) and 111-119 (76th-90th percentile). More than two-thirds of the parents never attended school, or only received education up to Form 3. Nearly 80% of mothers were housewife and 78.7% of fathers were labour or semi-skilled workers. A significant numbers of children with ADHD, Borderline ID, Mild ID and Severe Language Disorder / SLD had significant or borderline internalizing and/or externalizing behaviours.
Conclusions	Majority of primary-one school children referred for LD do not have intellectual disability. Their clinical diagnosis and non-verbal ability were very variable. A significant number of them have poor socio-economical background and associated behavioural problems. A more realistic education system and targeted program should be offered.
Keywords	LD - non-verbal ability - behavioural problems - screening
Abbreviations	ADHD = Attention Deficit Hyperactive Disorder, ID = Intellectual Disability, NNAT = Naglieri Non-Verbal Ability Test®, SLD = Specific Learning Disability, LD = learning difficulty

INTRODUCTION

Paediatricians and Medical Officers in government clinics were increasingly faced with children screened and referred by schools who has learning difficulty (LD); mostly in the context of under-performing in the academic area and examination. The medical professional are expected to assess these children to detect the diagnosable conditions which may prevent them from performing well in school. This is partly due to awareness, i.e. more parents and teachers are aware of the needs of children with LD; and partly due to advocacy from all parties, which include parents, professionals, non-governmental organizations, community to improve the care and service rendered to special needs children. In 2010, Ministry of Education Malaysia decided that one of the National Key Result Areas for Education was "Every child to acquire basic skills in literacy and numeracy after 3 years of primary school education (by end of 2012)". In conjunction with this, school children in primary-one with LD were referred for medical assessment after screening, and provided with special remedial curriculum under the LINUS (Literacy & Numeracy Screening) Programme [1].

Lau King Howe Memorial Children Clinic is a community clinic of Department of Paediatrics, Sibu Hospital based in Agape Centre, Sibu which sees all children with special needs (include those with developmental, behavioural and learning problems) from Sibu and the nearby regions. The clinic is supported by nursing staff and therapist as well as being funded by Sibu Divisional Health Office of Sarawak State Heath Department. It is therefore ideal for this clinic to conduct a study the clinical pattern as well as cognitive and behavioural profiles of children referred for LD.

AIMS

This paper aimed to study the clinical diagnoses and non-verbal ability of primary-one school children referred with LD after the paediatric assessment, as well as associated behavioural issues and socio-economincal background.

METHODS

All primary-one school children referred by the schools to Lau King Howe Memorial Children Clinic for the year 2010 were studied retrospectively. Other children with developmental disabilities but presented to this Clinic at younger age before 2010 were excluded. Demographic data, results of Naglieri Non-Verbal Ability Test® (NNAT®) and details of assessment by Paediatricians were retrieved from the clinic case notes. Results of other developmental and behavioural assessment were also retrieved if performed during the assessment. For clinical diagnosis, it was a combination of the history, physical examination, and behavioural and developmental assessments using standardized tools. The children were not automatically diagnosed as intellectual disability (ID) or having normal intelligence solely based on NNAT® results. Parents and schools were contacted for the LINUS programme results if these details were not available in the clinic notes.

NNAT® used progressive matrices to tests students' nonverbal reasoning and general problem-solving ability, suitable for 5 through 17 years of age. It included pattern completion, serial reasoning, reasoning by analogy and spatial visualisation. It provides a norm-referenced scores (standard scores with a mean of 100 ± 15, and percentile ranks and age equivalents) [2]. The clinic used Lea Symbols developed by Lea Hyvarinen for visual acuity test, and Colour Vision – Testing Made Easy by T.L. Waggoner for colour vision test.

Seven children underwent developmental assessment using Griffiths Mental Development Scales – Extended Revised (GMDS-ER) and all children with NNAT® score above 85 underwent Paediatric Neurodevelopmental Profile. GMDS-ER is a standardized assessment tool which measures development trends significant for development, or indicative of functional mental growth in young children from birth to a developmental age of eight years [3]. Paediatric Neurodevelopmental Profile was developed by Oberklaid and Sewell at the Royal Children's Hospital, Melbourne and designed to measure children's developmental abilities (age 5 to 12) in a number of areas thought to be important for learning at school [4]. The Dyslexia Early Screening Test (DEST-2) and Dyslexia Screening Test-Junior (DST-J) were used to assess the children for reading failure [5,6]. These dyslexia tests were normed for children aged 4½ to 6½ years and 6½ to 11½ years respectively.

Behavioural assessments were performed using standardized and formal tool such as Childhood Behaviour Checklist (CBCL) and Behavioural Rating Scale (BRS). The CBCL was a device by which parents or other individuals who knew the child well rate a child's problem behaviors and competencies. It reported the children's internalizing (i.e. anxiety, withdrawn, depressed and somatic) and externalizing (i.e. rule breaking and aggressiveness) behaviours that were observed by the adult guardians [7]. Permission to use the English CBCL as well as Chinese and Malay translations of the CBCL was obtained from the author under the License No. #349-02-23-09. BRS was a commonly available self-administered questionnaire by parents and teachers of which the questions were based on DSM-IV criteria for ADHD. The version of BRS used in this study was adopted from Centre for Community Child Health at the Royal Children's Hospital, Melbourne. For children suspected of autism, Gilliam's Autism

Rating Scale – 2nd Edition (GARS-2) was used, in addition to the standard interview and observation based on DSM-IV criteria. GARS-2 is a norm-referenced instrument that assists teachers, parents, and clinicians in identifying and diagnosing autism in individuals aged 3 through 22 and in estimating the severity of the disorder [8].

DATA ANALYSIS

The data was analysed using Microsoft Excel 2010. Statistical analysis involved descriptive analyses of the children demographics, NNAT® scores and behavioural reports. Further statistical analysis was conducted using χ^2 tests in qualitative data. T-tests were used to analyze quantitative data. A p value of equal and less than 0.05 was considered statistically significant.

RESULTS

There were 246 above-6 years old children attended Lau King Howe Memorial Children Clinic seeking paediatric consultation for developmental, behavioural and learning problems in the year 2010. Ninety-three of them (37.8%) were primary-one school children referred for LD and 72.0% of these children (n = 69) did not pass the LINUS screening programme (Table 2). LINUS results could not be traced for the others because parents / teachers were not contactable for consent to retrieve such results. The mean age for these 93 children was 7.10 +/- 0.36 years (62.4% were male). By ethnic group, there was no significant difference between the ethnicity and sex (p = 0.97). The ethnic breakdown was reflective of the population seen in this clinic (Table 1). Two types of primary schools were available in Sibu and the nearby regions, namely those national primary schools which use Malay language as the medium, and those Chinese primary schools which use Chinese as the medium. There were no significant difference between the school types and sex (p = 0.73).

Table 1 Basic demographic data of primary-one school children with learning difficulty

		Male (n = 58)	Female (n = 35)	Total (n = 93)	p-value
Mean Age ± SD (years)		7.10 ± 0.35	7.09 ± 0.39	7.09 ± 0.36	0.96
Ethnics	Iban	40 (69.0%)	23 (65.7%)	63 (67.7%)	0.97
	Chinese	15 (25.9%)	10 (28.6%)	25 (26.9%)	
	Malay	2 (3.4%)	1 (2.9%)	3 (3.2%)	
	Melanau	1 (1.7%)	1 (2.9%)	2 (2.2%)	
School Types	National School (Sekolah Kebangsaan)	32 (55.2%)	18 (51.4%)	50 (53.8%)	0.73
	Chinese Medium School (Sekolah Jenis Kebangsaan Cina)	26 (44.8%)	17 (48.6%)	43 (46.2%)	

Table 2 summarised the clinical diagnosis for children assessed. Majority of them had Borderline ID (n = 35, 37.6%), followed by Mild ID (n = 18, 19.4%), ADHD (n = 11, 11.8%) and Specific Language Disorder (include Dyslexia, n = 10, 10.8%). Four children had normal intelligence without specific cause and 3 children did not attend the follow up clinic (assessment was incomplete). Two children had bilateral sensori-neural hearing loss and one child had low vision. There was no significant difference between sex and diagnoses (p = 0.24).

Table 2 Clinical diagnoses of primary-one school children referred for Learning Difficulty

	Male (n = 58)	Female (n = 35)	Total (n = 93) p = 0.24	LINUS Results (F = failed, DNS = did not screen, NC = not contactable)
Borderline Intellectual Disability	23 (39.7%)	12 (34.3%)	35 (37.6%)	25 F (71.4%); 1 DNS, 9 NC
Mild Intellectual Disability	11 (19.0%)	7 (20.0%)	18 (19.4%)	13 F (72.2%); 2 DNS, 3 NC

Attention Deficit Hyperactive Disorder	10 (17.2%)	1 (2.9%)	11 (11.8%)	10 F (90.9%); 1 DNS
Specific Learning Disability / Dyslexia	6 (10.3%)	4 (11.4%)	10 (10.8%)	7 F (70%); 2 NC, 1 pass with help
Autistic Spectrum Disorder	3 (5.2%)	2 (5.7%)	5 (5.4%)	1 F (20%); 3 NC, 1 Pass
Severe Language Disorder	-	3 (8.6%)	3 (3.2%)	3 F (100%)
Bilateral Sensori-neural Hearing Loss	1 (1.7%)	1 (2.9%)	2 (2.2%)	1 F (50%); 1 NC
Low Vision	-	1 (2.9%)	1 (1.1%)	1 F (100%)
Moderate Intellectual Disability	1 (1.7%)	-	1 (1.1%)	1 NC
Incomplete Assessment	1* (1.7%)	2† (5.7%)	3 (3.2%)	2 F (66.7%); 1 NC
Normal Intelligence (no specific cause)	2 (3.4%)	2 (5.7%)	4 (4.3%)	4 F (100%)

*probable borderline intellectual disability; †probable dyslexia / language disorder

Table 3 summarised the NNAT® percentiles rank for the children who completed the test. Eight children did not complete the test because of refusal, inability to follow the instruction and/or not able to concentrate well during assessment. Only 9.4% (n = 8) of the children scored < 70 on NNAT® test (2nd percentile, consistent with ID), whereas 63.5% (n = 54) scored between 71 and 90 (3rd – 24th percentile, consistent with borderline / low average levels). Twenty-three children (27.1%) scored between 90 and 119, which ranked them as "average" or "above average" (> 25th percentile). No child scored > 120 on the NNAT® test. The mean NNAT® scores for the study group were 84.5 ± 11.4 (male = 84.6 ± 11.8; female = 84.4 ± 10.8). There was no significant difference between the sex and NNAT® scores (p = 0.94). Mean NNAT® score for children with ADHD were 94.2 ± 13.3 (n = 11, 2 refused the test), and those with Severe Language Disorder / SLD (n = 13) were 94.6 ± 9.7.

Table 3 NNAT® Percentiles and Mean Scores

NNAT Scores	Percentile (classification)	Male (n = 53)	Female (n = 32)	Total (n = 85)
≤ 70	≤ 2 pc (ID)	5 (9.4%)	3 (9.4%)	8 (9.4%)
71 - 80	3 – 9 pc (Borderline)	11 (20.8%)	13 (40.6%)	24 (28.2%)
81 - 89	10 – 24 pc (Low Average)	25 (47.2%)	5 (15.6%)	30 (35.3%)
90 - 110	25 – 75 pc (Average)	8 (15.1%)	9 (28.1%)	17 (20.0%)
111 - 119	76 – 90 pc (Above Average)	4 (7.5%)	2 (6.3%)	6 (7.1%)

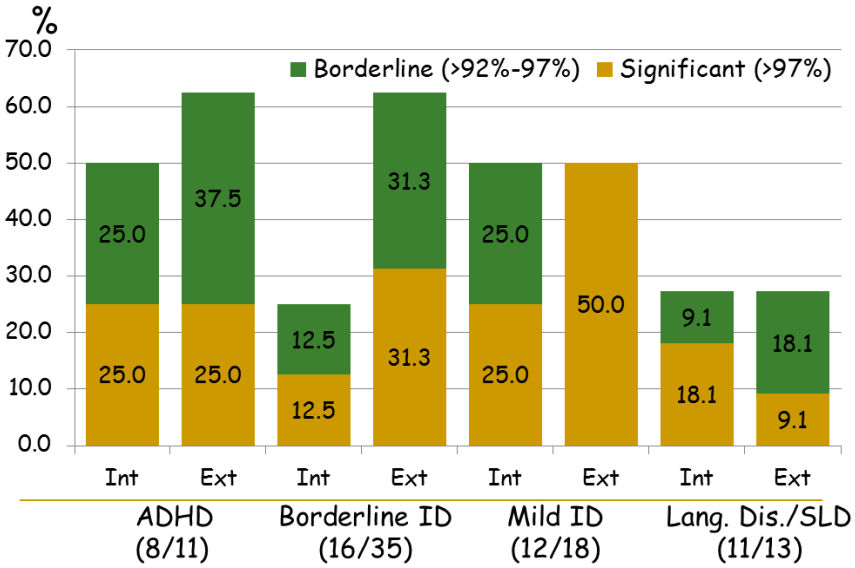
For the socio-economical background (Table 4), more than two-thirds of the parents never attended school, or received education only up to Form 3 (equivalent of Junior High School). Only four parents have university degrees. Seventy-five mothers (80.6%) reported themselves as housewife. There were 3 single fathers and 2 single mothers because of divorce.

Table 4 Parents' Education Level and Job

Category		Father (n = 93)	Mother (n = 93)
Parents' Education Level	Never Attend School	13 (13.8%)	17 (18.1%)
	Primary School & Below	21 (22.3%)	24 (25.5%)
	Form 3 & Below (Junior High)	28 (29.8%)	27 (28.7%)
	Form 5 & Below (Senior High)	10 (10.6%)	11 (11.7%)

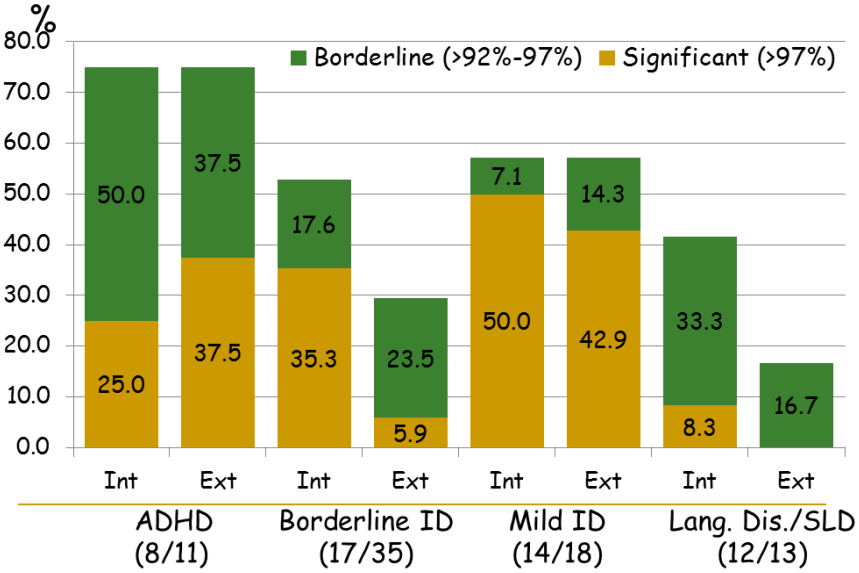
	Form 6 (equivalent of A Level)	1 (1.1%)	2 (2.1%)
	University Degree	4 (5.3%)	4 (5.3%)
	Did not specify	16 (17.0%)	8 (8.5%)
Parents' Job	Businessman	4 (4.3%)	3 (3.2%, all salesgirls)
	Divorce	3 (3.2%)	2 (2.2%)
	Farmer/Fisherman/Hawker	16 (17.2%, included 1 hawker)	3 (3.2%, included 1 hawker)
	Labourer/Driver	43 (46.2%, included 6 drivers)	2 (2.2%)
	Skilled Workers/ Army	16 (17.2%, included 1 army)	1 (1.1%, baker)
	Office Worker / Professional	7 (7.5%, included 1 engineer, 1 manager, 2 teachers)	5 (5.4%, included 1 manager, 2 teachers)
	Housewife	-	75 (80.6%)
	Did not specify	4 (4.3%)	2 (2.2%)

Chart 1 summarised the parental report of CBCL for children with ADHD, Borderline ID, Mild ID and Severe Language Disorder / SLD. Eight parents of the 11 children with ADHD completed the CBCL. Twenty five percent of the 8 parents reported that their children had significant (i.e. above 97th percentile) internalizing behaviours, and another 25.0% of the parents reported borderline (i.e. >92 – 97 percentiles) internalizing behaviours in their children. For externalizing behaviours, 25.0% of the parents with ADHD children who completed the CBCL reported significant concerns and 37.5% of these parents reported borderline concerns in their children. Only 66.7% (n = 12) of the parents of 18 children with mild ID completed the CBCL, of which 25.0% of them reported significant internalizing symptoms in their children, and another 25.0% reported borderline internalizing behaviours. Fifty percent of these 12 parents also reported significant externalizing behaviours in their children, but none for borderline concern. Chart 2 summarised teacher report of CBCL. No parents of the children with Severe Language Disorder / SLD (n = 12) reported significant externalizing behaviours, although 16.7% of them reported borderline behavioural problems.



ADHD = Attention Deficit Hyperactive Disorder, ID = Intellectual Disability, Lang. Dis. = Severe Language Disorder, SLD = Specific Learning Disability, Int = Internalizing, Ext = Externalizing

Chart 1 Parental Report – Percentage of Children with Significant and Borderline Internalizing and Externalizing Symptoms



ADHD = Attention Deficit Hyperactive Disorder, ID = Intellectual Disability, Lang. Dis. = Severe Language Disorder, SLD = Specific Learning Disability, Int = Internalizing, Ext = Externalizing

Chart 2 Teacher Reports – Percentage of Children with Significant and Borderline Internalizing and Externalizing Symptoms

DISCUSSION

Assessment of school children with LD was challenging and requires expertise. In contrast to the consultation of medical illnesses, it required the medical staff taking more time and much expertise to collect more relevant information from parents and schools before a diagnosis was made [9]. Various developmental tools and behavioural questionnaires were used to help with this process. The use of these tools and interpretation of its results required certain level of training; and some of these tools required formal professional qualification [2, 3, 4]. In addition, it required a multidisciplinary team approach with input from nursing staff and other allied health professionals.

Ideally children who have LD should have undergone formal psychological testing for their intelligence level using tool such as Wechsler Intelligence Scale for Children® (WISC®) by the clinical psychologists. However, this is not easily available in Malaysia. In this study, the authors used NNAT® to illicit the non-verbal ability of the study group. NNAT® is said to be ideal for use with children who do not speak English as their first language and culture fair [2]. It is also unbiased for minority students, hearing-impaired students, and children with impaired colour vision [2]. However, comparing to the formal cognitive test such as WISC®, NNAT® does not test the verbal skills and working memory components, both of which are important for learning academically. In this study, GMDS-ER was used to measures functional mental growth in young children below eight years of age [3], which did provide a full picture of cognitive functioning of these children.

With these limiting factors and challenges in mind, this study has demonstrated that majority of children in primary-one referred from schools have various diagnoses to account for their LD. The diagnoses were highly heterogeneous. Intellectual Disability was not the only diagnosis these children had. Conversely, many children had normal and above average non-verbal ability. It is important to note that this study excluded children who presented at younger age before the year 2010 and already followed up in this clinic. These children often have more severe developmental and behavioural concerns and were detected earlier in life by the health professionals.

The common diagnoses made in this study group were those of Borderline ID (not formally considered as ID) and Mild ID. It is important to realize that these children, especially those with Borderline ID (sometimes known as Slow Learner) are children who are happened to be on the lower part of the norm curve. They are very able to learn things that are appropriate for their developmental age. Allowing time to learn, realistic expectation and building up independent skills should be the prime aims of education for this group of children.

Some of the children in this study had ADHD, Severe Language Disorder and SLD. These children have normal intelligence, and their non-verbal ability as reported here were entirely within the normal range of the population. Some of the children were "treatable". Children with ADHD responded well to a combination of behavioural management, educational intervention and/or stimulant medicine [10]. Those with Severe Language Disorder will benefit from speech and

language intervention. For children with SLD (which include dyslexia), they do have difficulty in reading, writing, spelling and/or mathematics despite normal intelligence [11]. These children require remedial programme and trained teachers to assist with their learning process [11]. Therefore, it is important to differentiate these children with normal intelligence but having problem with LD because of their neurodevelopmental weaknesses. A few children in this study had hearing and visual impairment. Their learning experience in school could be enhanced with the hearing and visual aids fitted. It is therefore important to include formal visual and hearing tests during the assessment of children with LD.

In this study, a significant number of children had very under-privilege family background. A lot of their parents never attended or only received limited education themselves. This socio-economic disadvantage has subjected these children at risk for LD from the very beginning of their primary school lives. Social welfare support for this group of children is therefore vital in ensuring the children's growth and development as well as safety is not compromised by their poor socio-economical background.

In addition, children with ADHD, Borderline ID, Mild ID and Severe Language Disorder / SLD in this study were noted to have significant level of problems with internalizing and externalizing behaviours based on parental and teacher reports. Literature has reported findings of these comorbidities [12]. This is of paramount importance in terms of the children's mental health. Of course, it is difficult to be sure if these reported symptoms were primary problems the children had or as a result of their LD or as associated conditions, which were very well known among school children with learning disability [12]. Unhelp, these behaviours may give rise to more problems, and limited the growth and wellbeing of the children in time to come. These children require much ongoing support and surveillance, especially with their mental health aspects.

It is therefore important to realize that majority of these primary-one school children referred for LD has different learning needs, ability and diagnosis. Often, they have associated behaviours and comorbidities. When helping these children, it is important to address these children's ability and strengths, and offer them an educational program that works best for them. A one-model fit all "special education" that is currently available may not recognize their potential and it needs urgent revision.

CONCLUSIONS

Children with LD are a very prevalent problem and account for a big portion of paediatric workload as illustrated in this study. This study documented the heterogenous nature of clinical diagnoses and highly variable non-verbal ability of primary-one school children with LD. Although not doing well in the academic areas, majority of these children do not have criteria to "qualify" for intellectual disability. It is important to offer these children a good and individualised educational programme that works best for them. Allowing time and realistic expectation is important for these children to grow and learn in a supportive environment too. A one-model fit all "special education" that is currently available may not recognize their potential, and needs urgent revision. Health professionals need to offer on-going support for co-exist mental health problems after the diagnosis. Social welfare support for the children is also vital for supporting the under-privileged families.

LIMITATIONS

This is a self-selected group of children referred by school and who agreed to see doctors for assessment. It did not include all children who failed the LINUS programme or facing problem with learning in school. We acknowledge that not all children in this study underwent all the tests and assessment, largely due to the clinical needs and limited resources. This study is limited by the use of a non-verbal ability test, and this will not represent the full intelligence of the children. Furthermore, with the use of self-reported questionnaire, bias can be introduced intentionally or unintentionally by the parents and/or teachers. The clinic has been established for many years, and provides community-based services for children with developmental, behavioural and learning problems. The findings in this study may not be generalizable to other areas of the country with different and better health care set up and expertise.

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COMPETING INTERESTS

None identified.

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